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Occurrence and Control of Soybean Aphid, *Aphis glycines* Matsumura

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The soybean aphid, *Aphis glycines* Matsumura, is one of the most important pests of soybean. The *A. glycines* outbreak in 1998 followed another aphid outbreak after 1989, which caused enormous economic losses. The aphid infested areas exceeded 200 thousand *mu*, and the soybean yields decreased by 20%. Among aphid infested areas, 78 thousand *mu* were severely infested with a yield loss of 46%. More than 3,000 *mu* had no yield at all.

1 Characteristics of the Infestation

Adults and nymphs of *A. glycines* collected on the top tender leaves and stems, and extracted phloem sap with their piercing-sucking mouthparts, leaving numerous brown-yellow spots on the infested leaves. Heavy infestation may cause curling and premature loss of leaves, reducing numbers of branches and pods, reducing 100 kernel weight or even leaving bare stalks.

2 Morphology of Aphids

A. glycines belongs to the order of Aphididae, the family of Hemiptera. Winged viviparous females generally are long-ovoidal, yellow or yellow-green, 0.96 to 1.52 mm in length with red-brown compound eye and black head, whereas the wingless viviparous females are ovoid, yellow or yellow-green, 0.95 to 1.29mm in length. Their nymphs and adults are very similar morphologically.

3 Biological Habits and Dynamics of Population

3.1 *A. glycines* reproduces more than 10 generations each year mainly by parthenogenesis and viviparity. The eggs of *A. glycines* overwinter in auxiliary buds or branch-cracks of *Rhamnus dahuricus* trees. During the early May of the next year, winged alates emerge and begin to migrate to soybean fields in late May. A large number of winged aphids emerge in early and mid-September, and then migrate back to their overwintering host, and produce overwintering eggs by sexual propagation.

3.2 *A. glycines* is a monophagous and migrating pest. They spread and infest as winged forms. Their population dynamics have noticeable characteristics: they sporadically infest spots and blots at an early stage, then spread throughout the fields. In the end the number of aphid decreases.

3.2.1 The early spot and plot infestation stage: *A. glycines* migrates from *R. dahuricus* trees to soybean fields and the rate of infested soybean plants usually is about 1%. Thus, it presents the characteristics of spot and plot infestation in the early stage.

3.2.2 *A. glycines* migrates to soybean field and produces alate aphids parthenogenetically. These winged alates spread throughout the field rapidly, infesting the top tender leaves, and stems because of their tender-taxis, aggregating habit, and high reproductive capacity.

3.2.3 In late July, the soybean aphids migrate from the top to the middle-lower part of the host plants, because the growing parts of the plant cease growing and the temperature becomes unfavorably high. Meanwhile, light colored and small sized aphids gradually appear which grow and reproduce slowly. However, the number of natural enemies increases gradually during that

time. Thus, the number of aphids in fields decline at this time.

4 Affecting Factors

4.1 Egg number overwintered in *R. dahuricus*.

4.2 Climate factors:

From late April to middle May, plenty of rainfall nourishes *R. dahuricus*, which favors the development of soybean aphids. From late June to early July is the period just before the overwhelming outbreak of aphids. If the average temperature and relative humidity of every ten days are between 20 to 40 °C and the RH is <78% respectively, the populations of *A. glycines* could increase rapidly and cause severe damage at the florescence stage. The average 10-day temperatures from late June to early August of 1998 in Hulin city were 21.23 °C, 20.91 °C, 22.85 °C, 22.50 °C, 21.67 °C respectively, and the average rainfall was 9.2 mm, 73.4 mm, 0.8 mm, 0 mm, 9.1 mm respectively. Thus, the relative humidity was lower than the same periods before. These favorable climate conditions led to sustained mass reproduction and spread of aphids.

4.3 Natural enemies

There are many natural enemies of soybean aphids, such as Coccinellidae, Syrphidae, Chrysopidae, Aphididae, Carabidae and *Entomophthora aphidis* Fres., which could control the population of aphids. The extensive use of pesticides in past decades, especially synthetic pyrethroid insecticides, concurrently killed many natural enemies while they killed aphids. This could be another reason for the long lasting outbreak of aphids in 1998.

5 Control strategies

Using pesticides rationally, protecting natural enemies, and preserving dominant natural enemy populations in the fields should be recommended. When aphids sporadically infest soybean plants in the early growing season, spraying should only be applied at precise spots to restrain their dispersion and spread.

5.1 Cultivation control

5.1.1 Selecting aphid resistant or tolerant varieties.

5.1.2 Eliminating overwintering hosts. If it is possible, winter irrigation is recommended.

5.1.3 Chemical control

Control measures should be taken immediately when leaf-curling rate reaches 5 to 10%, when the percentage of infested plants exceeds 50%, or the aphid number per 100 plants is over 1500. Application of 1,500ml dimethoate 40% E.C., or 450ml mixed preparation tiaoxiaolin 30% E.C., or 750ml~1,000ml dimethoate 40% E.C. + 150ml~225ml deltamethrin 2.5% E.C., or 300 g imidacloprid per hectare sprayed on both sides of soybean leaves may achieve over 95% control effect. If 2250~3000g KH₂PO₄ and 1500 ml rice vinegar per hectare are added according to the growth conditions of soybean, we may achieve aphid control and fertilizing effects at the same time.